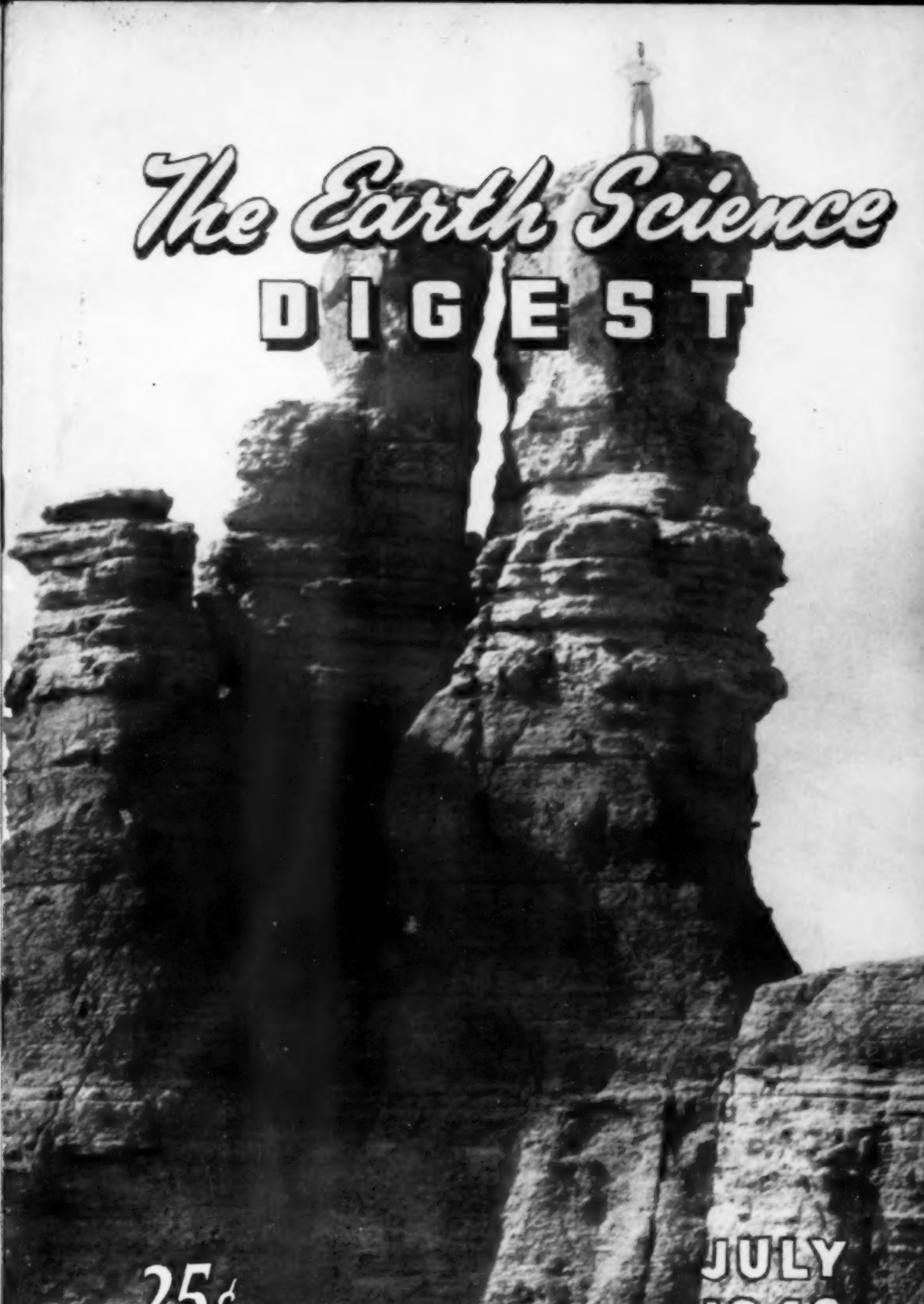

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S. Albert Eisenberg, Publisher

Gertrude Roberts, Business Manager

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Meetings and Conventions

Wyoming Geological Association, 4th Annual Field Conference. Aug. 9-13, 1949. Powder River Basin, Wyoming.

Rocky Mountain Federation of Mineral Societies, Annual Convention. August 25-27, 1949. Albuquerque, New Mexico.

Midwest Federation of Geological Societies, 9th Annual Convention. August 26-28, 1949. Davenport, Iowa.

Fourth International Conference on Quaternary Research. August 22-September 15, 1949. Budapest. Hungary.

Northwest Federation of Mineralogical Societies, Annual Convention. September 2-4, 1949. Eugene, Oregon.

Geological Society of America, 62nd Annual Meeting; Paleontological Society, 41st Annual Meeting; Mineralogical Society of America, 30th Annual Meeting; Society of Vertebrate Paleontology, 9th Annual Meeting. November 10-12, 1949. El Paso, Texas.

Magnetic Survey For Minerals By Airborne Magnetometer Has Proven Its Worth

WASHINGTON, June 24 (Science Service) — Surveying the crust of the earth for possible hidden metal ores and petroleum with magnetic instruments has proven its worth, the UNSCCUR will be told at its August meeting at Lake Success, N. Y., by J. R. Balsley, Jr., of the U. S. Geological Survey, it was revealed here. He will base his statements on the experience of the past five years with the airborne magnetometer.

The airborne magnetometer was used during the war floating through the air under and behind an airplane to detect submerged enemy U-boats in the Atlantic ocean. Its findings passed in electric signals to the plane by means of the trailer cable. During and since the war, this type of airborne instrument has been used to survey many thousands of square miles of territory in a search for hidden minerals, and particularly for geological formations in the crust of the earth favorable for petroleum.

UNSCCUR is an international organization promoting worldwide developments through the interchange of scientific knowledge. Its full name is the United Nations Scientific Conference on the Conservational and Utilization of Resources.

The airborne magnetometer is, according to Mr. Balsley, a high-speed, low-cost reconnaissance geophysical instrument which can be used to produce magnetic maps of the same order of accuracy as those produced by ground magnetic instruments.

It is not well suited for making small detailed surveys or for use in mountainous areas. It is particularly useful in areas which are difficult to traverse on foot, and in combination with radio and radar location systems can be used to conduct surveys over water or other unmapped oreas.

The over-all accuracy of the results of the airborne magnetometer can be most easily discussed by comparison with that of the more familiar ground magnetometer of the Schmidt type, he will say. The results of the aeromagnetic survey are compiled into a magnetic contour map or a series of magnetic profiles of the same type as those obtained by ground methods.

Although geophysical ground magnetic surveys usually measure variations in either the vertical or horizontal components of the earth's magnetic field, aeromagnetic surveys measure variations of the total field. In practice the two methods do not compete but complement each other.

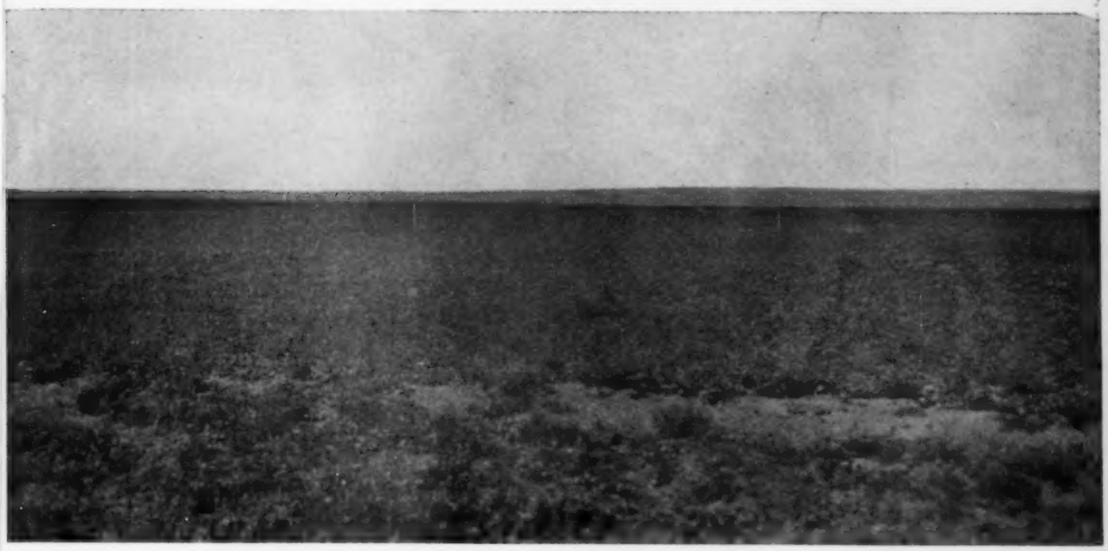
Cover Photo

This month's cover photo is of Castle Rock, a Cretaceous chalk spire in eastern Gove County, Kansas. See *"Scenic Kansas"*, pages 11-12. Photo courtesy of the State Geological Survey of Kansas.

SCENIC KANSAS

KENNETH K. LANDES

The author, formerly assistant director of the State Geological Survey of Kansas, is now chairman of the Department of Geology, University of Michigan.
This article is a condensation of the second edition of the booklet "Scenic Kansas", published by the State Geological Survey of Kansas.



The High Plains, view taken east of Garden City on US50 South

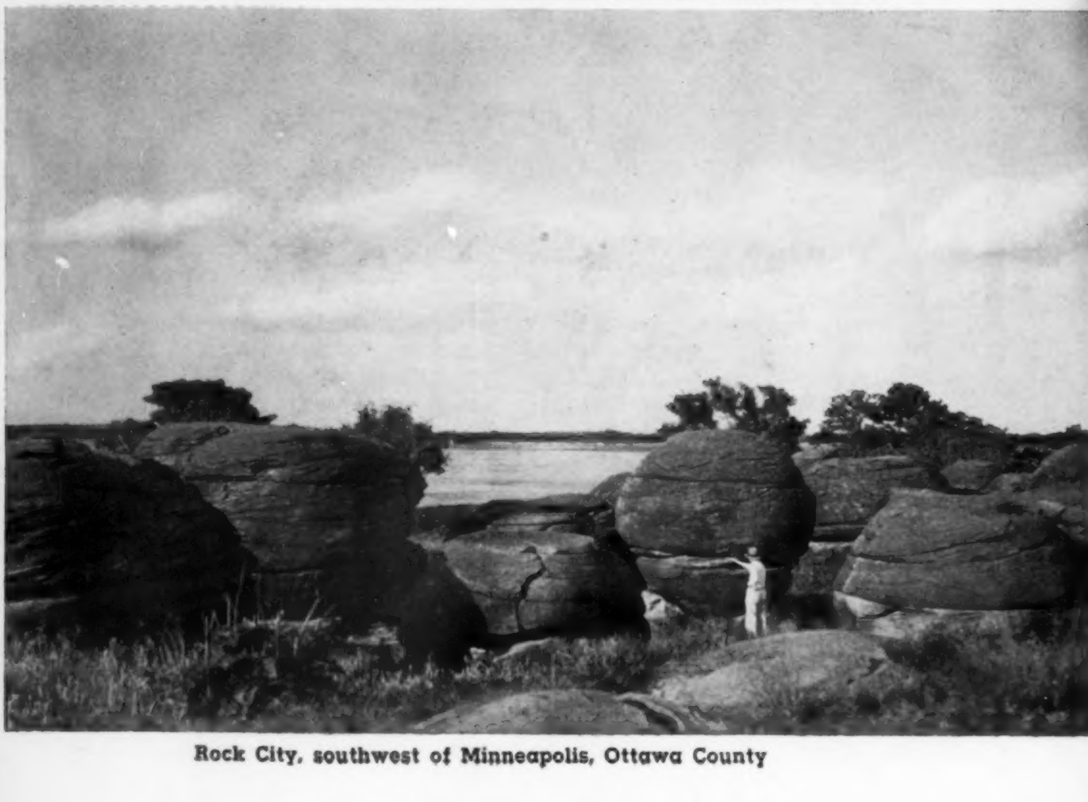
The gently sloping topography of the High Plains represents a part of the western third of Kansas. The High Plains were made by ancient streams that flowed eastward from the Rocky Mountains and deposited sand, gravel, and silt to a depth of many feet along a wide belt from Canada to Texas. In some places wind-blown dust covers these ancient stream deposits.

The second of the great Ice Age continental glaciers invaded northeastern Kansas as far south as Kansas River Valley. As the ice melted it left a quantity of loose rock and soil strewn over the surface to a depth of many feet. Streams have cut their valleys into the unconsolidated glacial material, producing landscapes such as the one pictured here.

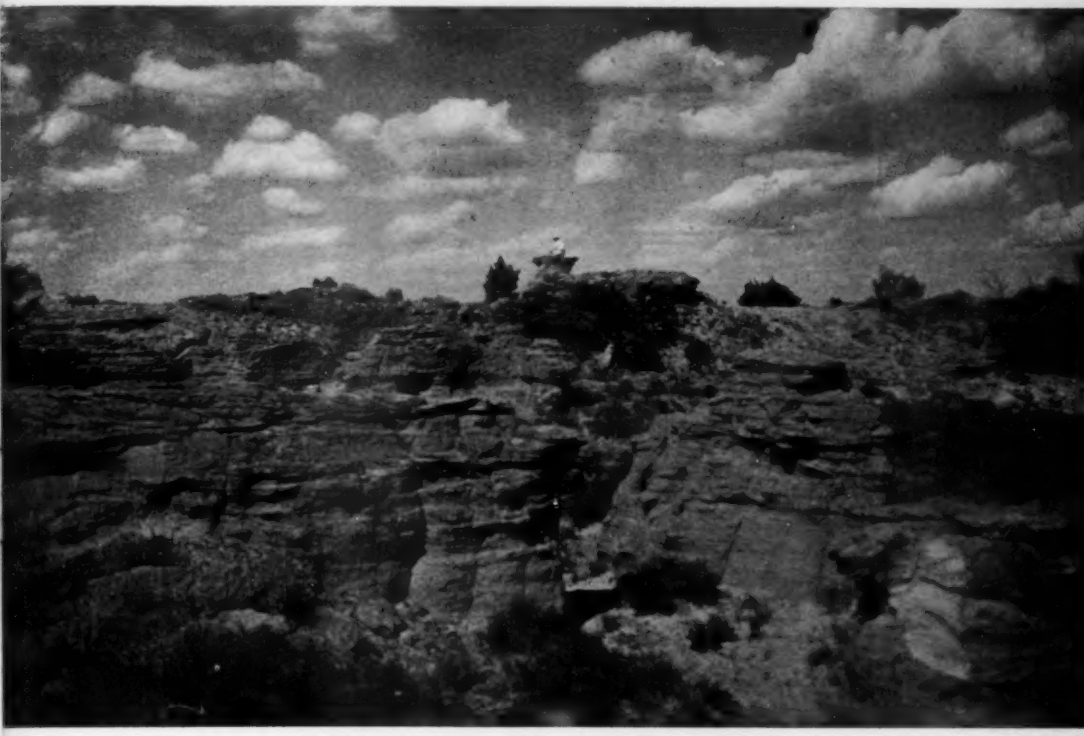
Eastern Kansas is characterized by broken topography and many outcropping rocks. Hard, resistant beds of limestone make mounds and valley rim rocks and terraces along the valley sides. The gentler slopes mark the shale outcrops. Sandstones, which affect topography in much the same manner as limestones, are fairly numerous in southeastern Kansas.

Rock City is noted for its 200 or more unusually well-formed large sandstone concretions. Some

Landscape in ice-visited northeastern Kansas, Doniphan County



Rock City, southwest of Minneapolis, Ottawa County



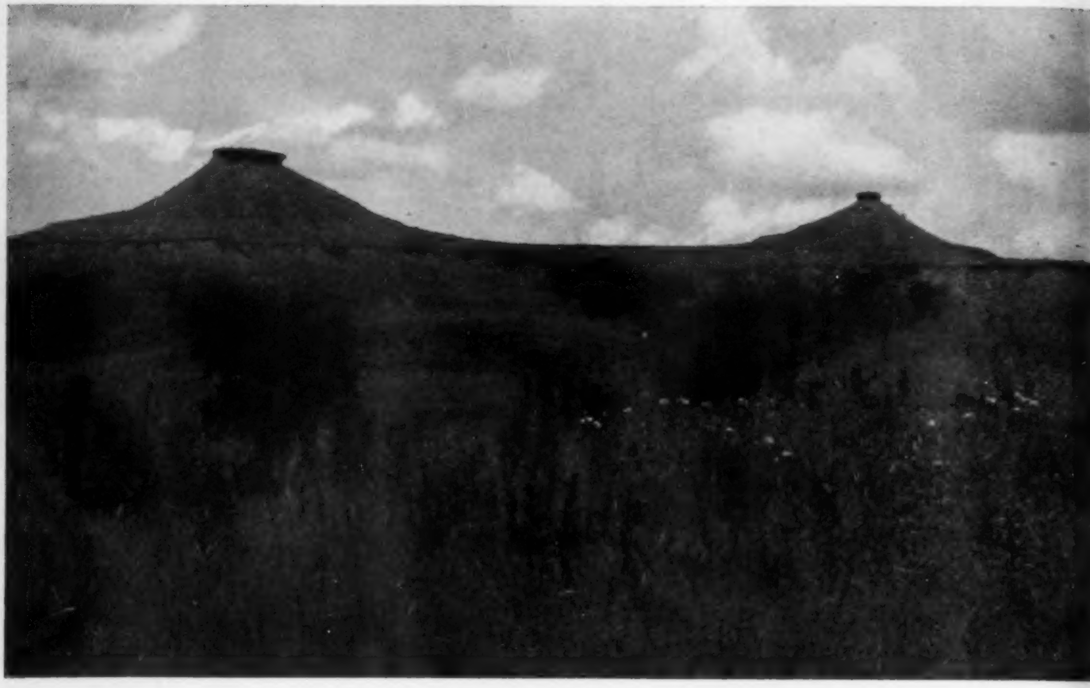
Hell's Half Acre, northeastern Comanche County

are almost perfect spheres with diameters exceeding 12 feet. Others, with diameters ranging from 8 to 27 feet, vary from rounded to elliptical forms.

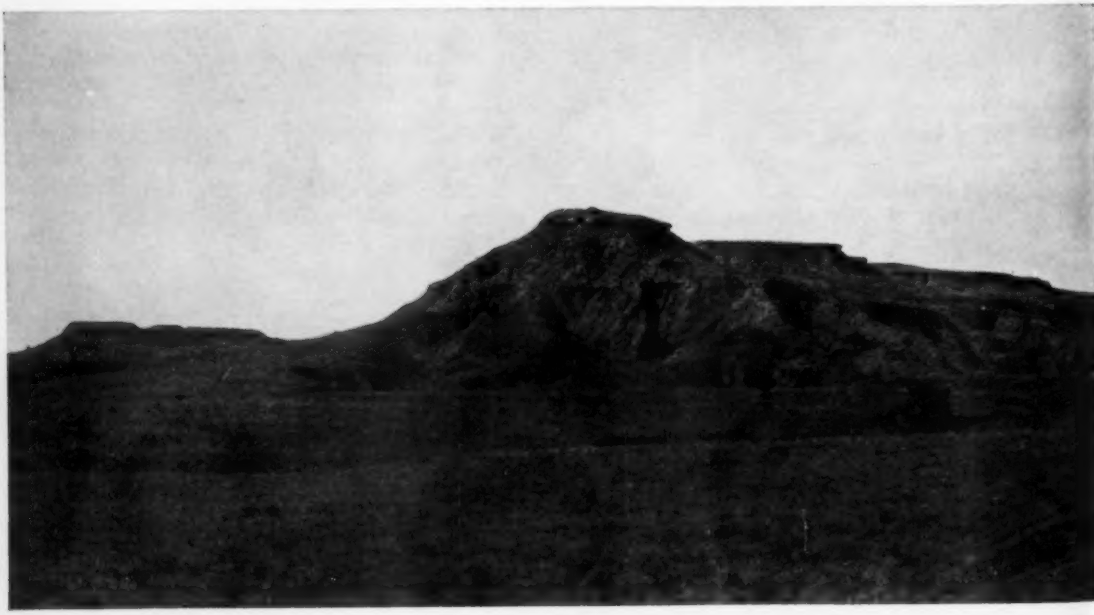
At one time, when the surface of the land in this area was higher than it is now, the sandstone rock occupying this space consisted of poorly cemented sand grains. Underground waters containing dissolved calcium carbonate circulated through the porous rock, depositing calcium carbonate in the open spaces. The precipitation of this calcium carbonate, which is a natural cement, began at many scattered points and continued outward in all directions from these centers. In this manner spherical bodies of tightly cemented sand grains — concretions — were formed within the sandstone mass. As erosion by wind, rain wash, and running water lowered the surface, carrying away the loosely cemented sand, the concretions were uncovered.

Hell's Half Acre, an interesting spot of badlands scenery, is erroneously named in that it covers at least ten acres. Many bizzare forms, including a multitude of "pulpit rocks," have been carved out of soft white sandstone by rain wash, running water, and wind. In the northern part of the area a small canyon has been cut through the white sandstone, exposing underlying redbeds. The white sandstone with its brown and yellow bands, the green foliage of the trees growing in the bottom of the narrow canyon, and the vivid reds of the lower canyon rocks make a striking combination of colors.

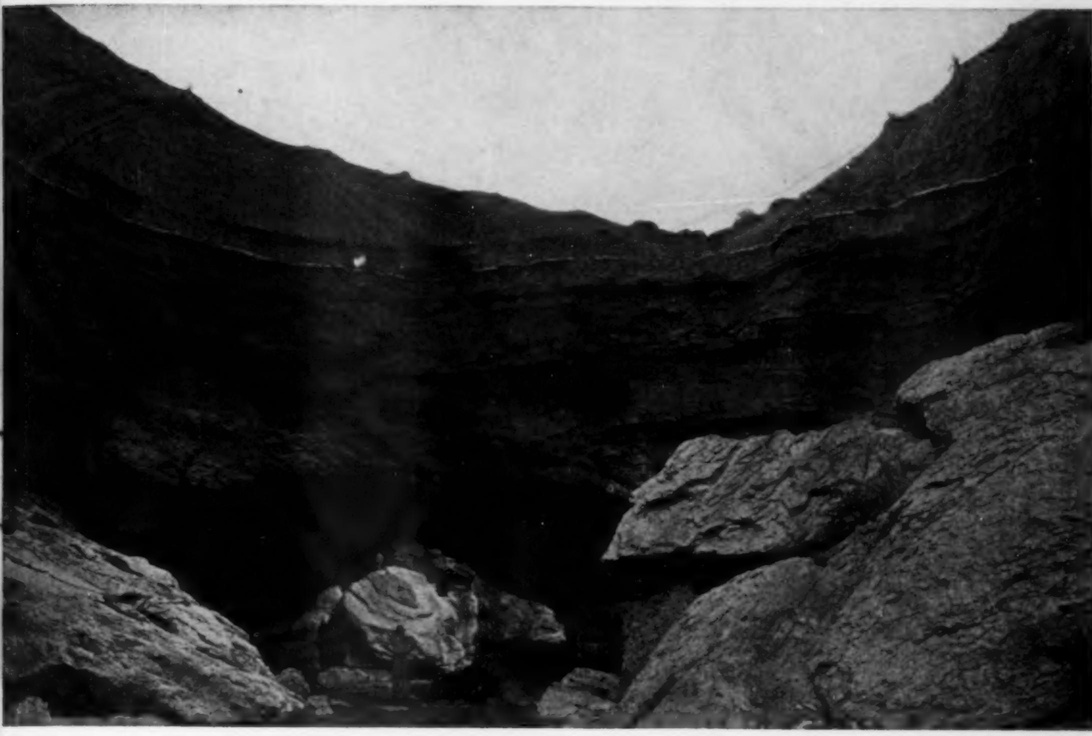
The red shales and sandstones



Twin Buttes, 8 miles west of Medicine Lodge, Barber County



Gypsum Hills, Barber County; view 3 miles southwest of Medicine Lodge



Natural Bridge, 6 miles south of Sun City, Barber County

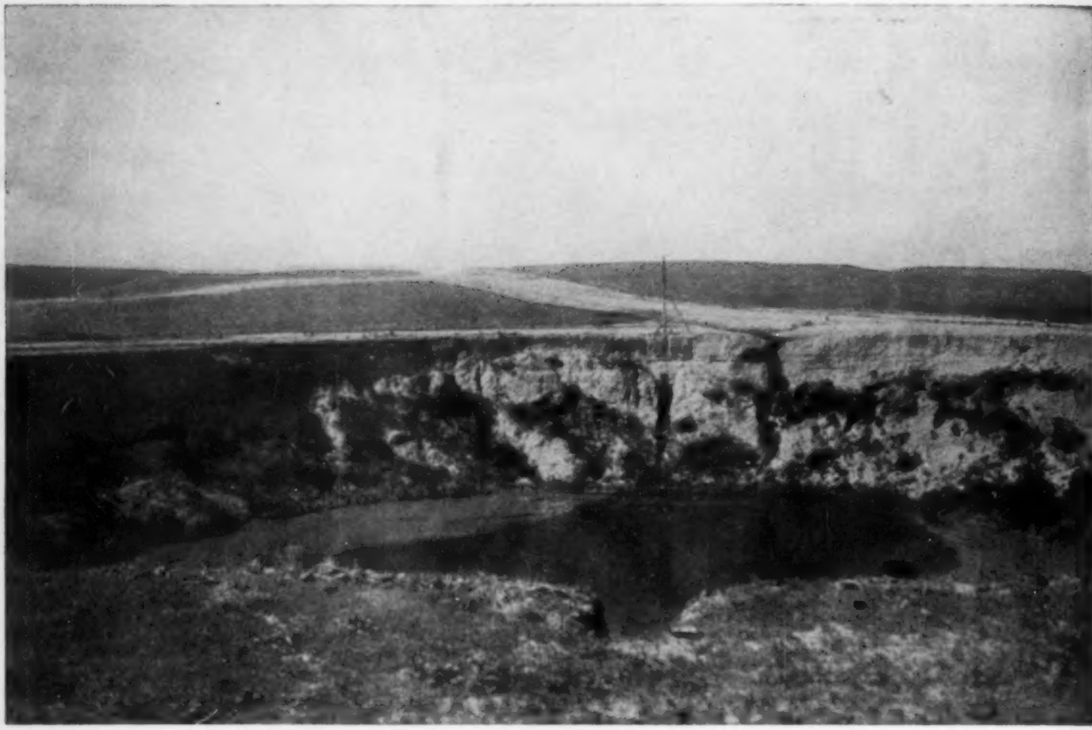
of southwestern Kansas were deposited in shallow lakes and seas under desert conditions. Later, when the ocean invaded the area, the sandstones and shales of Hell's Half Acre were deposited.

Between Medicine Lodge and Coldwater there are many colorful buttes and mesas. These isolated hills consist of bright red shales and sandstones capped by white gypsum. Although gypsum is normally a soluble rock, under certain conditions it may be very resistant and serve as a cap rock in buttes, as illustrated by the Twin Buttes.

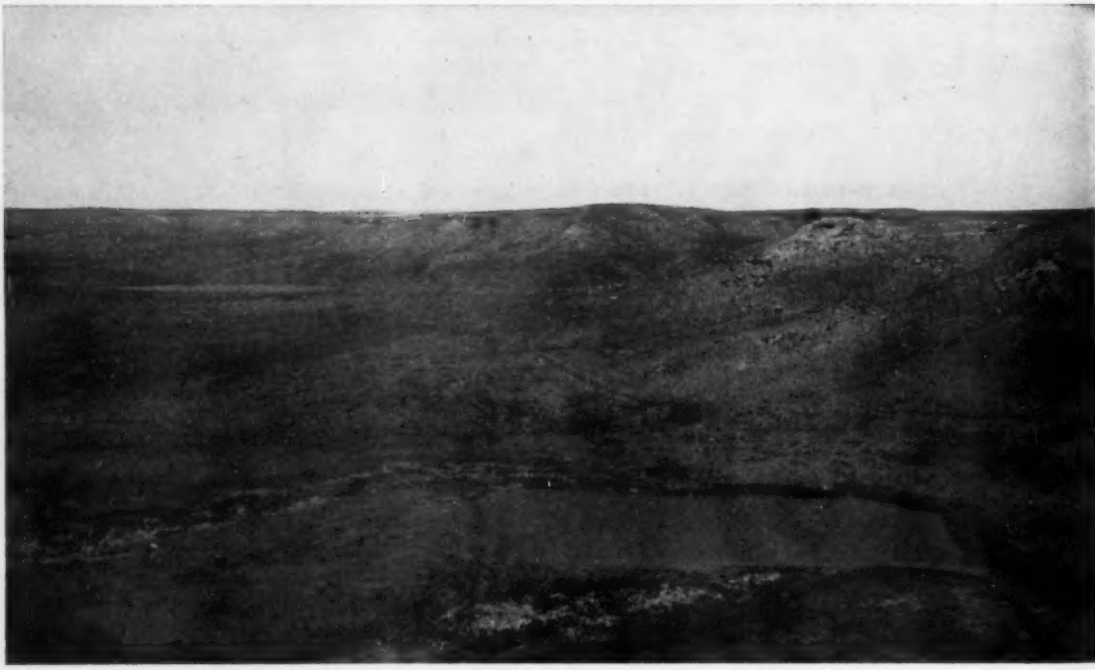
Mesas and buttes are hills that have resisted rain wash and other processes of weathering that have eroded away the adjoining country. Gypsum was formed long ago and is a direct precipitate of mineral matter held in solution in the ocean water which once covered this part of the State.

Kansas has a natural bridge. It crosses a small intermittent stream 6 miles south of Sun City in western Barber County. One can follow a trail across this gypsum bridge and, unless water is high, walk beneath it. The bridge is about 35 feet wide and 50 feet long. Its under side is about 12 feet above the stream bed. Near the bridge is a tunnel-like cave more than 250 feet in length.

The bridge and cave were formed out of the gypsum, much of which has been dissolved by circulating underground water. The bridge started as a cave into which surface water seeped. Eventually a stream broke into the cave and began flowing in a northerly direction through the tunnel-like open-



Hamilton County sink, 12 miles south of Coolidge on US50



Big Basin, 15 miles south of Minneola on US283, or midway between Meade and Ashland on US160 ing. Finally the ends of the tunnel retreated, leaving a remnant which today is the natural bridge.

Now and then we read about a hole suddenly appearing in the ground somewhere in western Kansas. These sudden cave-ins are known as sink holes and are due to the solutional work of subsurface waters. The Hamilton County sink, pictured here, began to form in 1930. Beginning as a small circular hole, the sides gradually slumped in until the county road shown in the picture was engulfed. The depression is now about 100 feet in diameter and about 50 feet deep and is partially filled with water.

The first step in the formation of a sink is the dissolving of soluble rock layers (probably gypsum in this case) by underground water, making caves. The falling in of the cave roof causes the depression or sink.

Many sinks have been formed in Kansas during historic time. In 1897 a sink hole 175 feet in diameter formed directly in the path of a cross-country trail near Meade. A year later an acre of land in Pawnee County slumped and took with it the Rozel railroad station. More recently, in 1926, the sink southeast of Sharon Springs in Wallace County came into being.

Big Basin is an unusually large sink in western Clark County. It is about a mile in diameter and approximately 100 feet deep. The rim rocks are the "mortar beds" of the High Plains, and the inner walls of the depression are composed of the "redbeds" of southern Kansas.

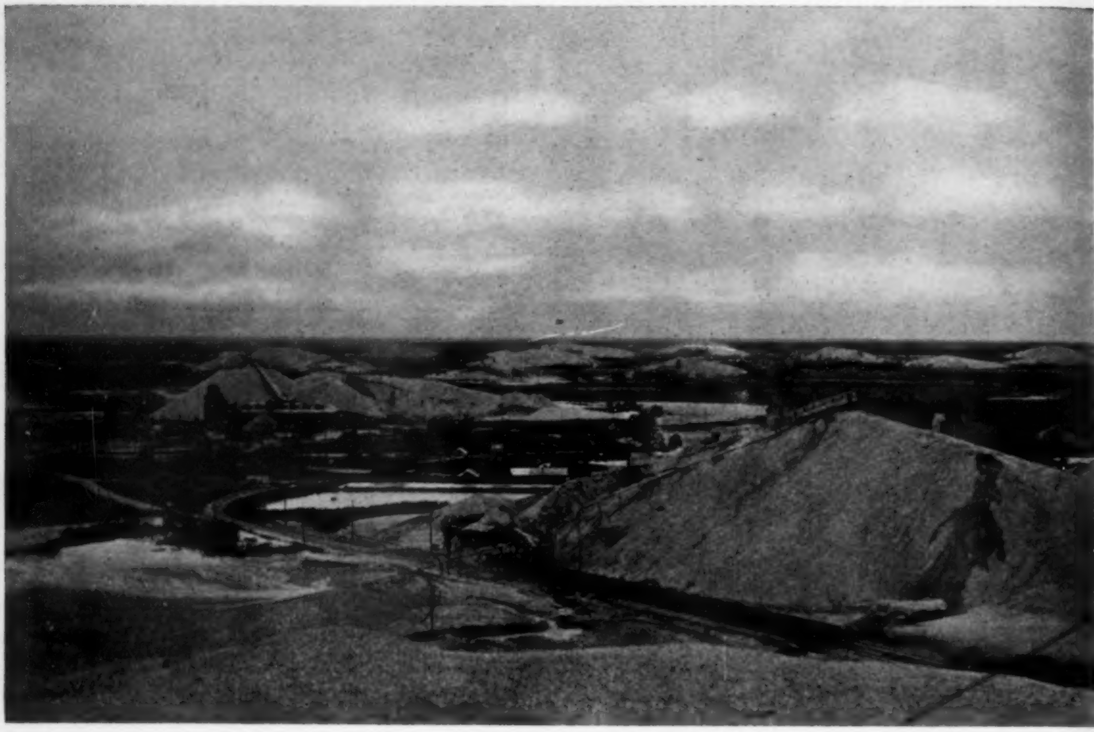
In the eastern third of Kansas, wide river valleys, which cut the upland, are floored with flood plains of silt on which a wide variety of crops is raised.

The rolling topography of the uplands is interrupted here and there by low eastward-facing limestone cliffs. Many of these limestone ridges cross eastern Kansas from north to south. The rock strata dip gently to the west and where the relatively hard limestones outcrop, a row of hills results. The Flint Hills, which stretch across Kansas from Nemaha to Cowley County, are an outstanding example of such hills. Thick beds of shale lie between the scarps.

Southeastern Kansas is a highly industrialized section of the State. Most of the State's coal and all of the lead and zinc are mined here. The Kansas section of the Tri-State zinc- and lead-producing district (Kansas, Missouri, Oklahoma) is in Cherokee County.

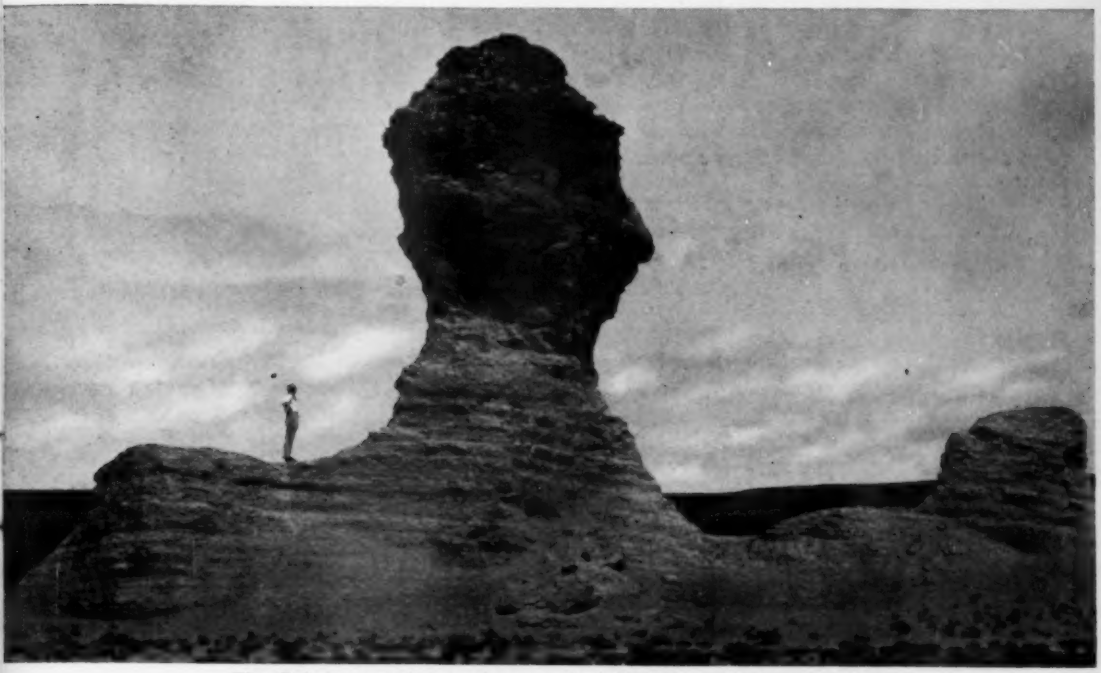
Most of the hills of this area are the result of mining activities and are therefore more man-made than natural. Associated with the lead and zinc ores are vast quantities of chert, a dense variety of quartz, which must be removed to secure the metals. The separation is done at the mills located on the surface. Here the ore is crushed into small particles and the zinc mineral, along with a lesser amount of lead mineral, is separated from the chert by ingenious mechanical devices which take advantage of the relatively light weight of the chert. Then the chert is carried out from the mills and dumped. Large piles of this waste product, commercially known as chat, have accumulated since the mining of lead and zinc was begun, giving this section of Kansas a unique topography. Many of these chat "mountains" are more than 100 feet high; some of them exceed 150 feet.

Millions of years ago, in Cretaceous time, the western part of the State was under water. The lands bordering the sea were low and the streams sluggish. The shells

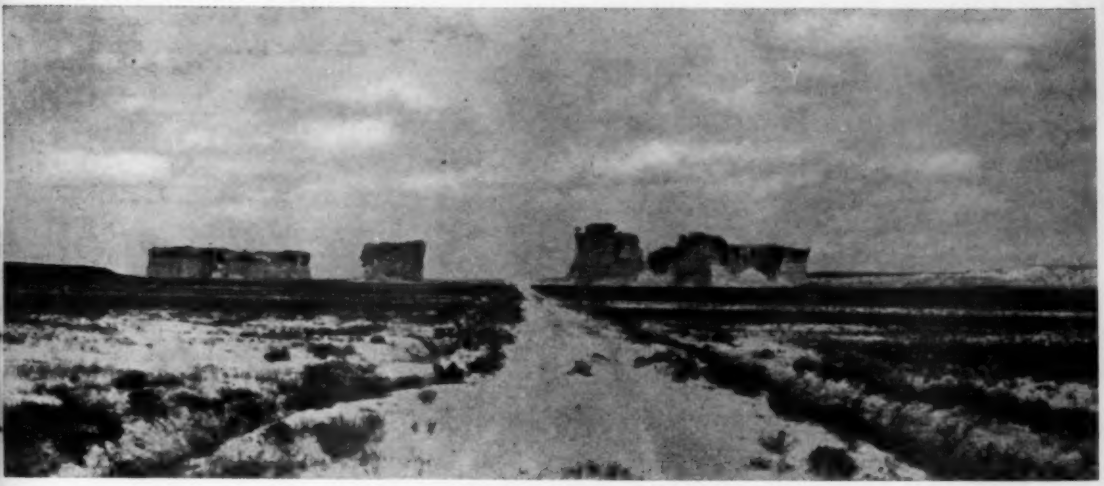


Cherokee chat "mountains," just north of the Oklahoma line, east of US69

Logan County, chalk bluffs, Smoky Hill Valley



The Sphynx, at the northern end of the Monument Rocks group



Monument Rocks, western Gove County

of many animals, microscopic in size, that lived in these waters, accumulated in abundance on the sea floor. They are now our chalk beds.

The chalk beds are world-famous for their reptilian fossils. Most of these ancient creatures were unusually large. Fossil remains 35 to 50 feet long have been found. Also 11-foot turtles and bird-like reptiles with teeth and 26-foot wing spreads have been uncovered.

Approximately 800 feet of chalk

and chalky shale were deposited in the ancient Kansas sea. Long after the deposition river erosion uncovered these chalky beds, fine exposures of which are found in Trego, Logan, and Gove Counties.

Rain wash, running water, and wind have carved the chalk into many bizarre shapes. Monument Rocks are erosional remnants in the form of pinnacles, small buttes, and spires.

World's First Hunters Were First Murderers

PHILADELPHIA, June 3 (Science Service) — Were the world's first hunters also the first murders?

The long-extinct walking man-apes of South Africa may have used bone clubs to kill other animals for their food, and perhaps also to crack each others' skulls. Evidence tending to show this is presented by Dr. Raymond A. Dart of Johannesburg, South Africa, in the new issue of the *American Journal of Physical Anthropology* published here.

Dr. Dart and his colleague in research, Dr. Robert Broom, have long insisted that the man-apes must have walked erect, and because of this and their teeth, they should be placed in the side of man rather than the side of the apes. The scientists have been vindicated in the last two years by finding pelvic bones of two man-ape types, Plesianthropus and Australopithecus, which could only have belonged to upright animals like man.

Artifacts of culture, however, present a more difficult problem. Up to now, anthropologists have been barely willing to concede that the more advanced Java man, Pithecanthropus, probably had recognizable tools of stone. Nonetheless, Dr. Dart is satisfied that the Australopithecus who lived in the caves at Makapansgat did indeed use clubs of bone.

Recognizing that this case called for a corpus delicti, Dr. Dart decided to make a systematic examination of the remains of various kinds of baboons found in all the caves used by the man-apes, at Makapansgat, Sterkfontein and Taungs. He sought the advice of Dr. R. H. Mackintosh, professor of forensic medicine at the University of the Witwatersrand, who has wide knowledge of skull wounds caused by lethal weapons, and with injuries to the skull and skeleton involved in other causes of death. Of some 58 baboon skulls and jaws, almost all gave evidence of breakage by heavy blows. Many were on the left side, indicating that the blow was delivered by a right-handed animal.

Some of the fractures showed peculiar paired depressions such as would fit the twin ridges found on the lower end of large leg bones of herbivorous animals, a number of which were discovered in the caves. Finally, some of the skulls indicated that pieces had been peeled or broken out of the top by hand or by a bone point in order to allow the brain to be taken out for eating.

Dr. Dart finds that these many wounds were not due to the paws and teeth of carnivores, which might be suggested as a cause. Nor were they due to crushing by weight of rock during the time the bones lay fossilized in the cave material, for they gave clear evidence of having been made while the bone was fresh and before it had become fossilized.

Dr. Dart even finds evidence that the skulls of the several man-apes themselves were broken by the same kind of violence.

THE SEARCH FOR URANIUM

W. S. SAVAGE
Ontario Department of Mines

*Part Two of a Three-part Article**

Prospecting For Radioactive Minerals

"Radioactivity" in minerals is almost entirely confined to those containing uranium or thorium, and all such minerals are radioactive. Of all the other elements only two, potassium and rubidium, are definitely known to be radioactive, and these only to a very slight degree. The world-wide search for uranium is therefore synonymous with prospecting for radioactive minerals. We have briefly reviewed the extraordinary importance of uranium in present-day world economy and have studied the characteristics and mode of occurrence of the most important minerals. We will now sum up more specifically the details that may aid in the visual identification of radioactive minerals and consider the methods used for their detection.

(1) *Visual Identification*

Pitchblende, the most important primary uranium mineral, may be identified by its black color, metallic appearance, greasy or pitchy lustre, dense massive texture, and exceptional weight, and by its occurrence in the form of veins or stringer systems occupying faults, shear zones, or fractures.

Most of the other primary uranium minerals occur in nests, pockets, or similar aggregates of crystals, usually of small size or extent, sparsely and irregularly scattered through dikes of granite pegmatite.

In general, it may be said that any conspicuously heavy, black or dark colored minerals discovered in a pegmatite should be tested for possible uranium content. Such minerals may be difficult to distinguish visually from magnetite and ilmenite, but the latter can be readily identified by virtue of their magnetic properties. Greater weight serves to distinguish them from black tourmaline and also from hornblende. Cassiterite (the source mineral of tin) is another black mineral found in association with pegmatites. It is relatively heavy (specific gravity 7) and has a hardness of from 6 to 7, compare with a hardness of from 5 to 6 for uraninite, which has a specific gravity between 8 and 10.

Small amounts of secondary uranium-bearing minerals due to weathering are usually present in connection with primary deposits and on account of the brilliant colors — vivid shades of bright yellow, orange, and green — offer a useful guide for prospecting, but their absence does not eliminate the possibility of finding primary uranium minerals.

The decomposition of thorium minerals often produces a brown friable crust, and when they are present in association with uranium minerals this "capping" may mask the bright-colored secondary uranium minerals.

Many of the secondary uranium

* Published by permission of the Deputy Minister, Ontario Department of Mines.

minerals are strongly fluorescent, and a number of uranium localities have actually been discovered by use of the ultra-violet lamp. The secondary uranium minerals generally fluoresce with a strong yellow-green color.

Another characteristic of radioactive minerals, which aids in their identification, is their ability to discolor the minerals surrounding them. The feldspars around a radioactive mineral are generally discolored to a brick-red or brownish color.

Dark-purple fluorite and "smoky" quartz, which are sometimes found in pegmatites and veins of igneous origin, are believed to owe their color to the radiations from associated radioactive minerals.

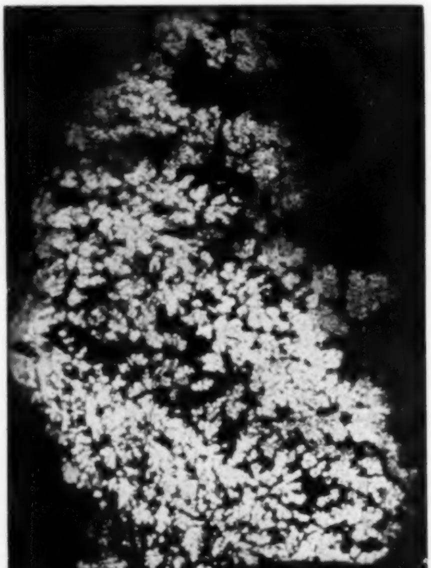
A radial fracture pattern created in the feldspar or quartz surrounding a mineral inclusion in a pegmatite is also often a useful indication that the inclusion is a radioactive mineral. This pattern is rather obscure in most cases and requires examination under a hand lens. A cart-wheel fracture pattern is often present, particularly in a brittle mineral such as quartz, with the radioactive inclusion forming the hub.

(2) *Determination by Radioactivity Methods*

All minerals containing uranium or thorium or both are radioactive; that is, they emit energy in the form of spontaneous radioaction and, this may be detected by several fairly simple means. It is not possible, however, to distinguish between the emission from the two elements except by precise laboratory methods. Before the invention of the Geiger counter, the principal aids in determining radioactivity were the photographic plate or film, the gold-leaf electroscope, and the spinthariscope. The Geiger counter is so much more versatile and more sensitive that the other methods have largely fallen into disuse and will only be briefly mentioned.

One of the simplest means for detecting radiation from minerals is to place the specimens on an ordinary photographic plate or film in a light-tight box and allow it to remain undisturbed for from 36 to 48 hours. On developing the negative, any marked radioactive content will be evidenced by a distinct image, or auto-radiograph, of the specimen.

The gold-leaf electroscope is a relatively simple laboratory instrument in which a strip of gold leaf or aluminum foil is held at a considerable angle from a narrow, vertical brass plate by a charge of static electricity. In the presence of radioactive material, the apparatus becomes electrically dis-



Harvard University

An autoradiograph of dendritic uraninite from the Ruggles Mine, near Grafton Center, New Hampshire.

charged and the leaf falls back against the brass plate. The rate of fall of the leaf depends directly on the intensity of the radiation, thus providing a means of comparing an unknown sample with a standard ore of known uranium content.

The spinthariscope consists essentially of a metal tube provided with a lens at one end and a glass plate coated with zinc sulphide at the opposite end. A small quantity of the mineral suspected of being radioactive is placed below the glass plate coated with zinc sulphide and examined in the dark through the lens. When the eye has become accustomed to the dark, and if the mineral is radioactive, small flashes of light may be observed as the radioactive particles impinge on the zinc-sulfide coating.

The Geiger Counter

The Geiger counter is the most useful and practical instrument for prospecting for radioactive minerals. Portable field sets are now available which are simple to operate, sensitive, and reasonably sturdy considering the principles upon which they operate. It is safe to prophesy that the search for uranium ores will continue for many years to come, and for any one engaged actively in prospecting for radioactive minerals, a Geiger counter is an essential piece of equipment. A review of the discoveries of radioactive minerals made during the past three years will show that the Geiger counter played a major role.

Any one intending to use a Geiger counter should know a few simple facts concerning its construction. The Geiger tube, from which the "clicks" heard in the earphone originate, is generally located along the bottom of the case, where it is closest to the ground in normal use. This tube, which is the "brain" of the instrument, has a high voltage applied to it, but there is no flow of current until radiation penetrates the tube. The "clicks" result from small currents produced in the Geiger tube by radiations, and the number of clicks per minute is directly proportional to the intensity of the radiation. The batteries and radio tubes that accompany the Geiger tube provide the high voltage on which the tube operates and so amplify the small current produced by radioactivity that it can be heard or measured. As the batteries weaken the voltage supplied drops off, and the voltage regulator must be adjusted. When the time comes that the batteries are too weak to provide the required voltage, they must be replaced. It is useful to carry spare tubes for the instrument in the field, and if it ceases to function, the trouble can generally be located by replacing the tubes one at a time. The life of an average Geiger tube is about 100 million counts, and the life, therefore, depends on how often and how long the instrument is exposed to highly radioactive material. It is not good practice to keep the instrument operating longer than necessary in the presence of highly radioactive material.

When properly adjusted, in the absence of strong radioactivity, clicks can be heard in the earphone at the rate of about 5 to 50 per minute. This count is known as the background count, and it results in part from radiations from space and in part from the small amount of radioactivity present in most rocks. It will vary in different localities, but should always be present to some extent if the instrument is functioning properly. If it is not heard, the instrument should be checked for weak batteries or faulty tubes.

The instruments in general use in the field fall generally into two

The Geiger Counter

types: a simple machine with earphones to detect the counts from the Geiger tube, and a more elaborate type provided with earphones and a rate meter. Either machine is satisfactory as far as detection of radioactivity is concerned, but the rate meter is very useful for more detailed work because it provides a means of comparing the amount of radioactivity in different locations. With only a slight amount of radioactivity, the clicks in the earphone run together so rapidly that it is not possible to count them.

In prospecting with the Geiger counter, it can be carried in its case over one shoulder with the strap fully extended. In this position it may detect radioactive minerals if present in quantities large enough to be of interest. The earphone is worn at all times, and care must be taken that the knobs for adjusting the instrument are not moved. Care must also be taken that nothing radioactive on the person is in a position where it will affect the instrument. Many compasses and watches have luminous dials, and these will have a marked effect on the Geiger counter.

If radioactivity is suspected in any area, the case containing the counter should be suspended close to the surface and moved slowly until the radioactive area is outlined.

While examining some radioactive mineral occurrences in Haliburton county for the Ontario Department of Mines last summer, Wolfe and Hogg found that radioactivity is effectively blanketed by from 1 to 2 feet of loosely packed earth. Working with a Geiger counter on the Camray property at Theano point, Lake Superior, two Ontario Government geologists, Satterly and Hewitt, found that although a very high count was registered where pitchblende veinlets were visible in the rock, from 5 to 10 feet away only a low background count was obtained. These limitations should be borne in mind when prospecting with a Geiger counter, and surveys should be carried out in extremely close detail.

General Precautions to be Observed in the Field Use of the Geiger Counter

(1) An electric storm may discharge a counter tube or may produce spurious clicks in the amplifying system. Hence, when a thunderstorm approaches, it is recommended that the use of the counter be postponed.

(2) Extra precaution should be taken to keep the counter dry at all times. Most field units have a 500-volt circuit, sometimes greater, and when short-circuited this can cause damage to the counter as well as produce severe shock.

(3) The background count may be thrown off due to the shielding of cosmic rays, by a high building, a thick forest, or a steep cliff. The background count is more or less characteristic of a given set, part-

icularly the tube, and whenever the tube or other parts of the Geiger set are changed or worked upon, the new background count should be ascertained. This background count may vary with the locality, even over relatively short distances, so frequent recheck must be made.

4) Radioactive dust must be carefully avoided. A small amount of dust that has been allowed to accumulate within the case or other parts of the counter will seriously affect the background count or will seriously impair the sensitivity of the counter for gamma rays.

(5) The Geiger counter should not be taken near a plant or mining operations where radioactive minerals are being crushed or treated.

(6) Likewise, the instrument should not be taken underground where radioactive minerals are being mined.

(7) An operator should keep his clothing, especially his boots, free of stray radioactive dust.

(8) As might be expected, the field Geiger counter is a precision instrument and should be protected from rough treatment, dropping, and corrosive vapors. It should not be placed where it may be overheated, such as near a camp fire.

When not in use, or during transportation, the Geiger counter should be provided with a strong, well-padded metal or wood box. Spare parts should be carried in a second box when extensive trips are made. If samples of radioactive ore are carried for check purposes, they must not be allowed in the same box as the counter, and must be carried separately.

Prospectors using the Geiger counter should realize that it is a qualitative instrument in the field and that a high count does not necessarily indicate the presence of valuable radioactive mineral. Both uranium- and thorium-bearing minerals will cause activity in the Geiger tube. Apart from the contained thorium, which is not at present of commercial value, the uranium itself is often present in minerals in such a form that recovery is not practicable. Even where uraninite has been identified in the field, in many cases it was found that other minerals were also present, such as allanite, thorite, etc. The cumulative effect of a large number of such minerals in a pegmatic dike may result in a high Geiger count, though it would not be possible to extract more than a very small percentage of uranium oxide.

Smithsonian Gets Skeleton of Ancient Crocodile-Like Animal

WASHINGTON, June 26 (Science Service — One of the rarest of fossil finds, the skeleton of a phytosaur, crocodile-like animal that lived 150,000,000 years ago, has been received at the Smithsonian Institution here. It was found in Arizona by workers of the U. S. Geological Survey.

Although shaped like crocodiles and living more or less as they do, the phytosaurs were not closely related. They were closer kin to the dinosaurs, though the cousinship even here was rather remote. There have been no phytosaurs since Upper Triassic geologic time.

Since most phytosaur skeletal remains hitherto turned up have been fragmentary, the newly discovered, almost complete skeleton has especially high scientific value,

HUNTING FOSSILS IN THE ARCTIC WITH THE AID OF A "SEEK SEEK"

HORACE G. RICHARDS

It is the business of a paleontologist when he goes on an expedition to bring back with him as many fossils as possible, within the limits of his time, finances and physical effort. Undoubtedly many fine specimens are present beneath the earth's surface, but are difficult or impossible to obtain because of the tremendous amount of excavating that would be involved. To simplify his task, the paleontologist usually looks for localities where the digging has already been done for him, for example in quarries, road or railroad cuts, tunnels, or even in deep wells.

Occasionally, in order to find some particularly important specimens, he actually does a little digging himself, or more probably he hires someone else to do the work.

On several occasions the writer has visited Arctic Canada to collect fossil shells and the remains of other marine animals that lived there during the Ice Age (Pleistocene).

One of these expedictions was to the west coast of Hudson Bay between Churchill and Chesterfield Inlet. The purpose of the trip was to collect these Pleistocene fossils and to use them in attempting to work out certain details of the geological history of the region, especially the changes in the position of the shoreline of Hudson Bay during the Pleistotcene. We were able to obtain some interesting material near the end of the railroad at Churchill and at several places along Hudson Bay between Churchill and the mouth of Chesterfield Inlet. However, our most important discovery was a raised beach some 100 feet above the shore of Baker Lake, a large freshwater lake at the end of Chesterfield Inlet, some 225 miles inland from Hudson Bay. This lake is separated from the Arctic Ocean by little more than 100 miles of low lying tundra. It seems highly probable that during the late Pleistocene there was a direct sea connection between Chesterfield Inlet (and probably other inlets to the north) and the Arctic Ocean. In other words, this "Northwest Passage" disappeared some thousands of years before the voyagers from the Old World began to look for it.

All this country is north of the "tree line" and is known as the Barren Lands, although there is a tendency in some circles to change the name to Arctic Prairies. Granite rock is not far beneath the surface, and is covered with a few feet of muskeg, a peat-like formation made up of the roots of mosses and lichens.

In some places where the Ice Age seas had covered the land, a sand deposit lies between the granite and the muskeg. It is this sand that frequently contains the fossil shells. How to find these specimens was our problem. In some places the sand had been exposed by erosion or by excavation, but in many places it was completely hidden by the muskeg, and it was difficult to tell just where we should dig.

One day when we were particularly discouraged and were pondering our problem, an unexpected ally put in an appearance. A short distance from where we were standing, we saw a little animal scratching the ground in a vigorous manner, thus loosening much of the hardened earth. This little creature had solved our problem for us!

Our unexpected ally turned out to be a ground squirrel (*Citellus parylii parylii* Richardson), a small but abundant member of the mammal fauna of the region. It is called "Seek Seek" by the Eskimos because of the peculiar whistle-like sound that it makes with its teeth.

These animals are about two feet long and are covered with a gray fur. They live in burrows in the muskeg on the Barren Lands. Often in the process of burrowing their burrows, the seek seeks penetrate into the fossil bearing sand, thereby throwing some of the shells to the surface.

The seek seek can easily be tamed; the one in the photograph was taken in the settlement of Chesterfield Inlet. Close relatives of the seek seek are known from Alaska and the mountains of the western United States.

The front of a seek seek burrow

The "Seek Seek"

More than once during our work along the shore of Hudson Bay we were able to collect the very shells we wanted in front of a seek seek burrow. Thus, these little animals were very helpful assistants and were responsible for a valuable part of the collections obtained by the expedition.

Billion-Year-Old Wormholes Discovered In Michigan Rocks

LONDON, July 4 (Science Service) — Billion-year-old wormholes, or burrows made by some creature equally low in the evolutionary scale, have been identified in Michigan rocks by Dr. Henry Faul, Massachusetts Institute of Technology geologist, who reports his studies in the science magazine, *Nature*, published here.

Dr. Faul suspects that the worms, or whatever made the burrows, were feeding on decaying vegetable or animal matter left on top of ancient shore sand that subsequently hardened into quartzite.

The specimens were found in a gold mine near Ishpeming, Mich. Age estimates based on helium contained in rocks of the same mine are on the order of 1,200,000,000 years.

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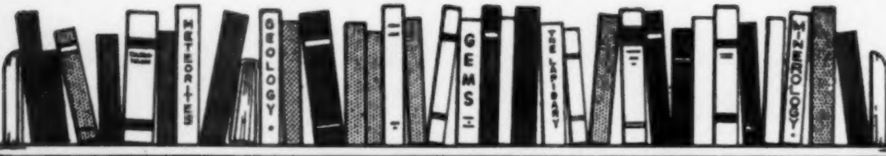

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